FMRI Studies in Adolescents with Alcohol Use Disorders

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FMRI Studies in Adolescents with Alcohol Use Disorders

- AUD = alcohol abuse or dependence

- Cognitive functioning
  - Alcohol
  - Alcohol + other substances
  - Gender differences
  - Premorbid factors

- Cue reactivity
% Used in Past Month

Source: Monitoring the Future, 2003
Brain Development

Volume
Metabolism
Myelination
Blood Flow
Receptors
Synaptic Refinement

Prenatal Age
Post-birth Age

Rate of Change

Tapert & Schweinsburg (in press)
Brain Response in AUD Youths

Task: Spatial Working Memory

AUD > Controls  AUD < Controls

Tapert et al. (2001). ACER.
Hangover/Withdrawal Effects

- Withdrawal symptoms predict abnormal brain response to SWM task among AUD teens

**Lifetime withdrawal symptom count**

**Past 3 month withdrawal symptom count**

↑WITHDRAWAL $\propto$ ↓BOLD  
↑WITHDRAWAL $\propto$ ↑BOLD
Nicotine & Alcohol

- **Performance:**
  - Modestly ↓ cognitive flexibility
  - Further ↓ by alcohol withdrawal

- **Brain response:**
  - Modestly ↓ brain response to pattern recognition task
  - Greatest effect for early onset smoking
Marijuana & Alcohol

Ages 14-17

Task: Spatial Working Memory

Alcohol+Marijuana Use Disorders

Schweinsburg et al. (in prep).
Gender Differences

**Girls**

**Boys**

Task: Spatial Working Memory

Caldwell et al. (in prep.)
Premorbid Factors

- Family history of AUD
- Conduct disorder
Family History of AUD

Task: Go/No-Go

FHP<FHN
in left middle frontal gyrus (BA 47/11)

Schweinsburg et al. (in press). ANYAS.
Family History of AUD

<table>
<thead>
<tr>
<th></th>
<th>FHN</th>
<th>FHP</th>
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<tbody>
<tr>
<td>Non-drinker</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td></td>
<td></td>
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<tr>
<td>Disordered</td>
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FHP teens show less prefrontal response.

Orange = increased working memory response.
Conduct Disorder (CD)

- AUD+CD less working memory response than AUD-only

- AUD+CD more working memory response than AUD-only

Task: Pattern Recognition

Barlett et al. (in prep.)
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- Cue reactivity
Cue Reactivity: Adolescents

Alcohol Pictures

Non-Alcohol Pictures

Tapert et al. (2003). Arch Gen Psychiatry
Cue Reactivity: Adolescents

- Alcohol picture trials relative to non-alcohol beverage trials:
  - Orange: AUD teens had more response to alcohol pictures
  - Blue: Controls had more response to alcohol pictures
Cue Reactivity: Adolescents

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Anterior cingulate & NAc
Cue Reactivity: Adolescents

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Hypothalamus

LEFT HEMISPHERE
Cue Reactivity: Adolescents

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Hypothalamus
Cue Reactivity: Adolescents

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Posterior cingulate/Precuneus
Cue Reactivity: Adolescents

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Posterior cingulate/Precuneus
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Inferior frontal gyrus
Cue Reactivity: Young Adults

- Alcohol Stroop
  - Alcohol words
    - "KEG"
    - "BINGE"
  - Non-alcohol words
    - "FIG"
    - "SHAVE"

Alcohol words:
AUD > control
AUD < control

Subcallosal cortex/NAc

Tapert et al. (2004). Addictive Behaviors
Summary

1. Disrupted brain activity
   • Reorganization and compensation early in AUD
   • Hangover/withdrawal linked to greater abnormality

2. Effects vary
   • Gender
   • Other substance use
   • Pre-existing vulnerabilities

3. Abnormally enhanced response to alcohol cues

4. Longitudinal studies are needed
   • AUD initiation
   • AUD resolution
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